

Observations, &c. (*continued*).

Observations faites au Cap Thørdsen, Spitzberg. Tome II.  
Fasc. 2-4. 4to. *Stockholm* 1887.

The Meteorological Office, London.

Kiel :—Commission zur Untersuchung der Deutschen Meere.  
Ergebnisse der Beobachtungsstationen. Jahrg. 1887. Heft 7-9.  
Obl. 4to. *Berlin* 1888. The Commission.

London :—Navy Medical Department. Statistical Report. 1887.  
8vo. *London* 1888. The Department.

Stationery Office. Voyage of H.M.S. "Challenger." Report.  
Zoology. Vol. XXIX. Text and Plates. 3 vols. 4to. *London*  
1888. The Office.

Lyme Regis :—Rousdon Observatory. Observations. 4to. [Sheet.]  
1889. Mr. C. E. Peek.

Manchester :—Public Free Libraries. Annual Report. 1887-88.  
8vo. *Manchester*. The Committee.

*February 14, 1889.*

Professor G. G. STOKES, D.C.L., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read :—

- I. "Magnetisation of Iron at High Temperatures." (Preliminary Notice.) By J. HOPKINSON, F.R.S. Received January 30, 1889.

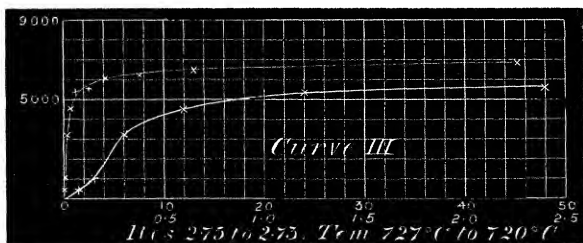
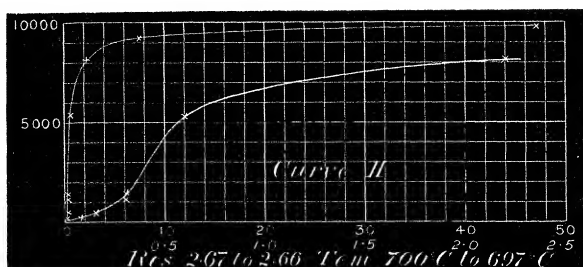
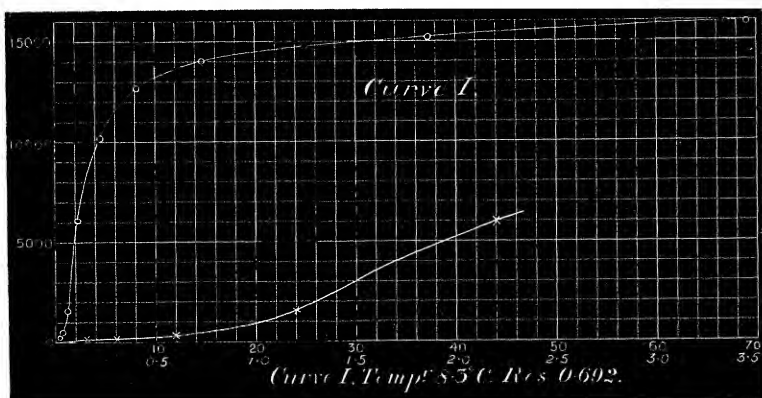
I have recently been making some determinations of the curves of magnetisation of iron at varying temperatures up to that at which the iron ceases to be magnetic. Although the experiments are still progressing, some of the results are of sufficient interest to be worth publishing briefly at once.

The method of experiment was identical with that which I used for a sample of nickel about a year ago. The temperatures are estimated by the resistance of a copper secondary coil, and as there may be some uncertainty as to what temperatures the several resistances correspond with, I give in the curves which follow the resistance observed as well as the temperature estimated.

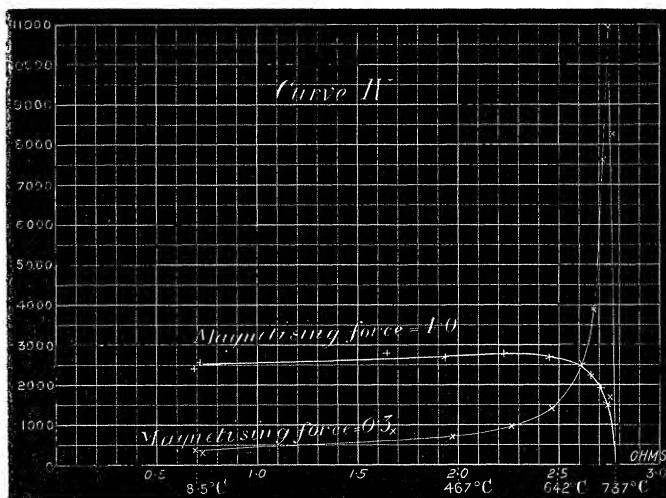
Curve I shows the relation of induction to magnetising force at the ordinary temperature, the resistance of the secondary coil being 0.692 ohm. The curve is given to two scales, the scale of induction being the same in each, whilst the scale of magnetising force is magnified twenty-fold in the one as compared with the other.

Curve II shows the same relation for a temperature of 697° C. to 700° C.

Curve III shows the same thing for a temperature between 727° C. and 720° C.



These curves illustrate what has been long known, that rise of temperature causes increase of induction if the magnetising force is small, but diminution of induction if the force is great.



In Curve IV the abscissæ are temperatures, the ordinates are the ratios of induction to magnetising force or permeabilities for a force of 4.0, and of 0.5 C.G.S. units, the data being supplied from the preceding and other curves. The latter curve brings out a most remarkable feature. For this force the permeability increases somewhat steadily to a temperature of about 640° C., its rate of increase then rapidly accelerates, till it attains a maximum of 11,000 at a temperature of 727° C.; at 737° C. the permeability is practically unity, or the magnetisability of the material has entirely disappeared.

Regarding the iron as made up of magnetic molecules the axes of which are directed to parallelism by magnetic forces, the results are expressed by saying that the magnetic moment of the molecule diminishes with rise of temperature, at first slowly, but very rapidly as the point is approached at which magnetism disappears; on the other hand, the facility with which the particles are directed continually increases, at first slowly, but at high temperatures very rapidly. The effect is that at a temperature of 720° C. an exceedingly small force is competent to turn the axes of nearly all the molecules in a direction parallel to the magnetising force.

The estimates of temperature given herein must be accepted as provisional, and subject to revision. The actual temperatures are undoubtedly materially higher, as I have not yet taken into account the part of the secondary wire outside the furnace.

[If an iron ring which has never been magnetised has its curve of magnetisation determined for an ascending series of forces, if it be then thoroughly demagnetised by a succession of reversed currents of descending intensity, and the curve of magnetisation is redetermined, I find that the two curves differ materially. The demagnetising currents do not reduce the iron to its virgin state. For small forces the second curve is below the first, indicating less induction for the same magnetising force; for medium forces the second curve is above the first, whilst for large forces the two curves agree.

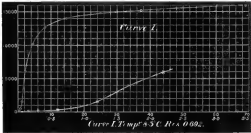
If a ring be heated with a current through the primary coil and the heating be continued till the ring has ceased to be magnetic, if then the current be stopped and the ring be allowed to cool, I find that the ring is not entirely demagnetised by the heating, but that it recollects its state of magnetisation before heating. It would seem that the magnetic molecules of the iron, having been directed by the magnetising force whilst they were magnetic, retain in part their direction when they have ceased to be magnetic by heating, and that when they again become magnetic by cooling its effect is apparent.—February 14, 1889.]

I have tested a sample of manganese steel, and find that at no temperature above the normal temperature does it become substantially magnetic.

II. "On a Series of Salts of a Base containing Chromium and Urea.—No. 2." By W. J. SELL, M.A., F.I.C. With Crystallographic Determinations by Professor W. J. LEWIS, Cambridge. Communicated by Professor G. D. LIVEING, F.R.S. Received February 1, 1889.

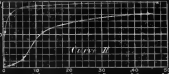
In a former paper ('Roy. Soc. Proc.,' vol. 33, 1882) a number of salts were described derived from a base formed by a combination of chromium with urea. It was stated that the chief product of the regulated action of chromyl dichloride on dry urea, and subsequent treatment with water, is a green crystalline powder, insoluble in alcohol, ether, or chloroform. The compound thus obtained contains chlorine as an essential component, while, as noted, the product of crystallisation from hot water is the pure dichromate of the base. At the date of the previous publication the nature of this green salt, as a preliminary to the study of the reaction by which it is produced, was under investigation. The present paper deals with these subjects, and describes a number of additional salts of the base.

The failure in the attempt to purify the green salt by crystallisation from water, added to its insolubility in all other available neutral



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